Lab grown blood fit for human transfusion, a regenerative medicine first

We're one step closer to a future where blood shortages are a thing of the past. Instead of donors, our supply of blood for those in need would be mass-produced in factories. At least, that's the promise from Marc Turner, medical director at the Scottish National Blood Transfusion Service, leading a project by the Wellcome Trust. Turner told Forbes Paul Rodgers that "We have made red blood cells that are fit to go in a person's body."

> The artificial blood [is] derived from stem cells that have been made from an adult donor's skin or blood. These donor cells are genetically rewound to become induced pluripotent stem (iPS) cells, which have the potential to develop into any of the body's 200 tissues.
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> The iPS cells are cultured for a month in a chemical environment, similar to that found in bone marrow, that encourages them to mature into red blood cells. Up to half of them do so. Standard techniques, such as centrifuging, are then used to separate the artificial blood from other cells.

This man-made blood has several advantages over traditional donor blood. To benefits, as accounted by Rodgers and others:

First, the produced blood is all Type O negative — "universal donor" blood. Normally this type makes up less than 10 percent of the available blood. A large supply of Type O negative would streamline the process of finding acceptable transfusions. When people are losing large amounts of blood, having the right type on-hand can make all the difference. There is no risk of blood-born diseases. Blood grown in a lab is disease-free and there's no risk of a fresh transfusion transferring HIV.

Third, patients could get fresh blood cells. Normally, red blood have a 120 day life cycle. With donor transfusions, the cells being given could be anywhere in that 120 cycle — they could begin to naturally die off a few days or weeks after transfer. Lab-grown cells could be used at the start of their lifespans, maximizing the effectiveness of each transfusion.

A fourth observation, one not touched upon in any of the pieces I've read, involves the social dimension of blood donation. Blood has a short shelf life. The way we do things now, the donor blood supply is available at the whims of the populace. People may donate more than is needed after a tragedy. The blood being used in an emergency will already be on the shelf, and a post-tragedy surplus, no matter how well-intentioned, may go to waste. Supplies typically run low in summer. Making the supply of blood more directly responsive to the needs of hospitals seems like a major benefit to switching from donor-based to lab-grown blood transfusions.

Blood factories are, at this point, still just a rosy promise. Other efforts to mass produce blood have been — and are being — pursued. Notably, truly synthetic blood created without the aid of stem cells has had mixed success so far.

What sets this announcement apart is Turner's confidence that the cells he's grown are ready for transfusion — and the UK's regulatory agencies seem to agree. The cells are currently slotted for human trials 2016. Approval for human trials and the setting of date is, if nothing else, the logical next step following a spate of headlines out of Scotland almost one year ago announcing that the UK had given the go-ahead to produce blood from stem cells.

Assuming the trials are successful, Turner and his team would still need to successfully scale up their technique to industrial levels of a future filled with blood factories is in the offing. As io9's George Dvorsky notes, "This will be no small feat considering that, in the UK alone, there are two million units of blood transfused each year."

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Sources:

- "First Artificial Red Blood Cells Made," Paul Rodgers | Forbes
- "Soon We May Be Mass Producing Human Blood," George Dvorsky | io9
- "Artificial Blood Is Patient-Ready," Jef Akst | The Scientist
- "First volunteers to receive blood cultured from stem cells in 2016," Wellcome Trust

Additional Resources:

- "Factory Made Blood Nearing Human Trials," Lisa Winter | I Fucking Love Science
- "Lab grows blood for human trials," Michael Franco | CNET